# Framework Connection System

## Related Applications

The present invention claims the benefit of U.S. Provisional Application No. 60/390,489 filed June 21, 2002 and entitled "Framework Connection System," which is hereby incorporated by reference in its entirety.

## Field of The Invention

The present invention is related generally to displays having support framework and graphical displays for use as exhibits at trade shows and the like. More particularly, the invention relates to such displays that are dissassemblable and that utilize tubular components to selectively vary the frame configuration.

## Background of the Invention

Exhibits for tradeshows and other marketing venues utilize eye catching and informative graphical portions that are intended to inform and present an image to customers or potential customers. A common use will be at convention or exposition halls where perhaps a single day is allocated for each of setup and removal. To create desired attention-getting appeal, such displays can be massive in size and complexity. Moreover such convention space is usually extraordinarily expensive as is labor for set up and take down of the displays. Thus, such displays need to be designed to be easily and quickly erected and taken down. Such constraints often make these displays quite expensive. Moreover, often new fresh designs are desirable.

Thus it is preferable that the displays are easily reconfigureable allowing at least the structural framework components to be reused in alternate display configurations.

The above needs have been met to some extent with collapsible frameworks or collapsible trusses, as illustrated with U.S. Patent No. 6,149,021, and with box frame designs, as illustrated with U.S Patent Application Nos. 09/953,111 and 09/953,113. While all of these systems have their advantages, the collapsible systems cannot support extensive weight and the exposed truss systems present an industrial look. Large diameter tubular framework systems present a very desirable visual alternative. Such systems have been used in trade show type displays but have not had the flexibility and reconfigurability desirable in this type of product line. Generally such large diameter tubular displays must be custom made for a particular design and involve welded connections and very large sections. Currently, such large framework systems are cumbersome and are often designed with one particular configuration in mind. If the members are not welded, they are generally joined using limited fixed joint connections. Predefined and fixed tees, cross bars, elbows, and the like are provided to join members in a particular configuration. An inability to selectively design and setup such steel tubular framework systems is problematic. It would be highly desirable to have a large diameter display utilizing large diameter tubing that is easily reconfigurable and dissassemblable. It would also be desirable to be able to incorporate such large diameter tubing framework systems with existing truss or box frame systems.

## Summary of the Invention

The display of the present invention addresses and solves many of the described problems that innately plague conventional displays. The present invention employs various

individual components that are easily interconnectable to provide the end user with a myriad of framework configuration options utilizing large diameter tubing. These components can be selectively connected so that only those components are used that provide the user with the optimal configuration. As such, connectivity options are increased with the selective combination of only those components which are needed to meet the user's needs. In addition, the relatively simplistic design of the components and locking options of the present invention improves ease of assembly, disassembly, and reconfiguration.

The framework connection system of the present invention generally comprises a plurality of frame members, preferably tubular, a plurality of end flanges, and a hub system. The hub system can comprise a hub plate assembly and/or a hub casting assembly. In addition, at least one clamp assembly, preferably cylindrical, can be included for circumferential attachment to the outer surface of the frame members to provide for selective removable fastening of various attachments and accessories at positions along the length of the frame members. The hub plate assembly and the hug casting assembly can be connected individually to the frame members, or in combination, to enable selective angular configuration of the frame members to construct a frame construction, such as those commonly utilized in display frame systems.

An objective and feature of the present invention is the selective use and re-use of common component, such as hub plate and hub assemblies, to provide for variable frame connection configurations. Displays ranging from the simple to the complex are achieved using the same common mateable components.

Another objective and feature of the present invention is the ability to selectively and modularly connect metallic tubing members, linear and curvilinear, to construct simple and complex frame connection configurations.

Yet another objective and feature of the present invention is a display constructed of a tubular framework having clean and substantially uninterrupted visual lines, thus avoiding the conventional implementation of cumbersome, bulky, and unappealing hub designs. The present invention provides for substantial circumferential continuity or visual consistency between the frame member and the connected hub assembly.

Still another objective and feature of embodiments of the present invention is a display constructed of strong and durable steel tubular frame members to allow for increased stability and strength while still permitting selective modular configuration.

Another objective and feature of embodiment of the present invention is that the various securing members, such as the set screws, provide engagement with the pins of the mating components to correspondingly bring the components into abuttable or confrontable alignment.

## Brief Description of the Drawings

Fig. 1a is perspective view of a display system constructed of a framework connection system in accordance with an embodiment of the present invention.

Fig. 1b is perspective view of a display system constructed of a framework connection system in accordance with an embodiment of the present invention.

Fig. 1c is perspective view of a display system constructed of a framework connection system in accordance with an embodiment of the present invention.

Fig. 1d is a perspective view of the connectivity of various components of a framework connection system in accordance with an embodiment of the present invention.

Fig. 1e is a perspective view of the connectivity of various components of a framework connection system in accordance with an embodiment of the present invention.

Fig. 2 is a perspective view of a linear tubular frame member in accordance with an embodiment of the present invention.

Fig. 3 is a perspective view of various curvilinear tubular frame members in accordance with an embodiment of the present invention.

Fig. 4 is a perspective view of an end flange in accordance with an embodiment of the present invention.

Fig. 5 is a side view of an end flange in accordance with an embodiment of the present invention.

Fig. 6 is a perspective view of a hub assembly in accordance with an embodiment of the present invention.

Fig. 7 is a side view of a hub assembly in accordance with an embodiment of the present invention.

Fig. 8 is a perspective view of a single branch hub plate assembly in accordance with an embodiment of the present invention.

Fig. 9 is a perspective view of a four branch hub plate assembly in accordance with an embodiment of the present invention.

Fig. 10 is a perspective view of the connectivity of a hub assembly and a single branch hub plate assembly in accordance with an embodiment of the present invention.

Fig. 11 is a perspective view of the connectivity of hub assemblies and a three branch hub plate assembly in accordance with an embodiment of the present invention.

Fig. 12 is a perspective view of the connectivity of hub assemblies and a two branch hub plate assembly in accordance with an embodiment of the present invention.

Fig. 13 is a perspective view of the connectivity of hub assemblies and an angular two branch hub plate assembly in accordance with an embodiment of the present invention.

Fig. 14 is a perspective view of a fixed corner assembly in accordance with an embodiment of the present invention.

Fig. 15 is a perspective view of the connectivity of a fixed corner assembly and tubular frame members in accordance with an embodiment of the present invention.

Fig. 16 is a perspective view of a portion of a pivot corner assembly in accordance with an embodiment of the present invention.

Fig. 17 is a perspective view of a portion of a pivot corner assembly in accordance with an embodiment of the present invention.

Fig. 18 is a perspective view of an assembled pivot corner assembly in accordance with an embodiment of the present invention.

Fig. 19 is a perspective view of the connectivity of hub assemblies, a two branch hub plate assembly, and an end cap in accordance with an embodiment of the present invention.

Fig. 20 is a perspective view of the connectivity of hub assemblies, an angular three branch hub plate assembly, and an end cap in accordance with an embodiment of the present invention.

Fig. 21 is a perspective view of the connectivity of various components of a framework connection system in accordance with an embodiment of the present invention.

Fig. 22 is a perspective view of an end cap and tubular frame member in accordance with an embodiment of the present invention.

Fig. 23 is a perspective view of the connectivity of an end cap and tubular frame member in accordance with an embodiment of the present invention.

Fig. 24 is a perspective view of an end cap and tubular frame member in accordance with an embodiment of the present invention.

Fig. 25 is a perspective view of the connectivity of an end cap and tubular frame member in accordance with an embodiment of the present invention.

Fig. 26 is a perspective view of the connectivity of a base stand and tubular frame members in accordance with an embodiment of the present invention.

Fig. 27 is a perspective view of a base stand, base pod, and tubular frame members in accordance with an embodiment of the present invention.

Fig. 28 is a perspective view of the connectivity of a base pod and tubular frame members in accordance with an embodiment of the present invention.

Fig. 29 is a perspective view of the connectivity of a base pod and tubular frame members in accordance with an embodiment of the present invention.

Fig. 30 is a perspective view of the connectivity of a base pod and tubular frame member in accordance with an embodiment of the present invention.

Fig. 31 is a perspective view of the connectivity of hub assemblies, a two branch hub plate assembly, and a base pod in accordance with an embodiment of the present invention.

Fig. 32 is a perspective view of a two piece clamp assembly in accordance with an embodiment of the present invention.

Fig. 32a is a perspective view of a hinged two piece clamp assembly in accordance with an embodiment of the present invention.

Fig. 33 is a perspective view of the connectivity of a two piece clamp assembly and a tubular frame member in accordance with an embodiment of the present invention.

Fig. 34 is a perspective view of the connectivity of a two piece clamp assembly, a collar frame connector assembly, and a tubular frame member in accordance with an embodiment of the present invention.

Fig. 35 is a perspective view of the connectivity of two piece clamp assemblies, a display mounting assembly, and a tubular frame member in accordance with an embodiment of the present invention.

Fig. 36 is a perspective view of a clamp assembly, a counter, and a tubular frame member in accordance with an embodiment of the present invention.

Fig. 37 is a perspective view of the connectivity of a single branch bracket device and tubular frame members in accordance with an embodiment of the present invention.

Fig. 38 is a perspective view of a two branch bracket device and connector blocks in accordance with an embodiment of the present invention.

Fig. 39 is a perspective view of the connectivity of a tubular frame member, an end plate, and a display frame in accordance with an embodiment of the present invention.

Fig. 40 is a perspective view of the connectivity of a tubular frame member, an end plate, and a display frame in accordance with an embodiment of the present invention.

## Detailed Description of Preferred Embodiments

Referring primarily to Figs. 1a-21, the framework connection system 10 in accordance with the present invention generally comprises a plurality of frame members 12, a plurality of end flanges 14, a hub plate assembly 16, and a hub assembly 18. Various embodiments of the

system 10 components, means of connectivity, and configuration options are described and shown in attached Appendix A, which is hereby incorporated by reference in its entirety. The frame members or segments 12 can be tubular steel tubing members, but in alternative embodiments, other materials and shapes can be employed. Each of the end flanges 14 are insertably attachable to at least one end of the frame member 12 such that the flange 14 is fixed within at least a portion of the tubing member 12. The flanges 14 can be fixed to the end portion of the frame member 12 with a weldment bond to facilitate connectivity with other system 10 components. Other methods and techniques of attachment understood to one skilled in the art are also envisioned.

Referring to Figs. 1a-3, and 21, the frame members 12 of one embodiment can be constructed of cylindrical steel tubing having a central bore therethrough, and include an end portion 21 and end apertures or recesses 22 providing communication into the central bore. Wire management openings can further be included along the outer surface of the members 12 communicating into the central bore to provide wiring and cabling options throughout the framework. The longitudinal length of the frame members 12 define an axis $a_1$. The members 12 can be of varying lengths, depending on the needs of the user. Other embodiments can be constructed of plastics other suitable materials, and can be constructed of square or rectangular tubing, or other shapes typically used to form display frame constructions. In one of the tubular embodiments, the members 12 can have an approximate outer diameter of 2 ½ to 4 inches. This outer diameter is preferably consistent along the entire length of the tubing, with the length being variable depending on the configuration needs of the manufacturer or end user. The tubing wall thickness is preferably in the range of .025 to .250 inches, but other dimensions are also

envisioned for use with the present invention. The members 12 can be straight or linear, as shown in Fig. 2, or arcuate or curvilinear, as shown in Fig. 3.

The inner diameter for the tubing bore is some size smaller than the outer diameter, for receiving the end flanges 14, with the end flanges 14 defining an axis $a_2$. The end flanges 14 include a body portion 23 and a face portion 27. The face portion 27 is generally cylindrical to match the shape of the end portion 21 of the frame members 12 such that the face 27 of the flange 14 substantially lines up with the end of the frame member 12, or is measurably inset, aligning axis $a_1$ and $a_2$. The flanges 14 can further include a central aperture or recess 24, a body aperture or recess 25, and a plurality of indexing or alignment apertures or recesses 26. Additionally, a plurality of indexing or alignment pins 28 selectively securable within the indexing apertures 26 can be provided. At least one connector pin 30, and at least one connector fastener 32 can be included as well. The connector pin 30 can include at least one securement groove 31 proximate at least one end of the pin 30. The connector pins referred to herein can be a one piece pin 30, or two distinct but joinable pins 42, 44, wherein one pin, i.e., pin 42, comprises male threading, and a second pin, i.e., pin 44, comprises female threading to facilitate connectivity. The longitudinal length of each pin 30, 42, 44 defines an axis $a_4$. Various components may require pin 30, others may require the connected combination of pins 42, 44, and yet others may only require the threadable insertion of pin 42. Regardless, reference herein to any of the referenced pins 30, 42, 44 is merely demonstrative as any one of the pins can provide the requisite connectivity described. Alternative embodiments of the pins 30, 42, 44 can take on various shapes, such as hexagonal or other non-cylindrical forms, along at least a portion of the longitudinal length. As such, the flats or edges of the non-cylindrical pin 30 are mateably inserted into the flange 14 central aperture 24 having a substantially similar shape such that

rotation of the confronting tubing members 12 along the common axis $a_1$ is limited as shown in Fig. 1e.

Referring to Figs. 1d-1e, and 4-5, the central aperture 24 traverses at least a portion of the face 27 of the flange 14 some distance inward through the body 23. The body aperture 25 traverses into the body 23 transverse or radial to the central aperture 24 such that the apertures 24, 25 are in fluid communication with each other. The body aperture 25 can further include a lip proximate the point of communication with the central aperture 24 to provide a stop for an inserted connector pin 30. When secured within the end portion 21 of the frame member 12, the body aperture 25 of the flange 14 is substantially aligned with the end aperture 22 of the frame member 12 such that a fastener, i.e., the at least one connector fastener 32, is insertable through both apertures 22, 25, radially in relation to axis $a_1$ and $a_2$, to fasten the connector pin 30 in place at the securement groove 31. The central aperture 24 and the body aperture 24 can be threaded for receipt of various fasteners and/or pins for component connectivity.

The indexing apertures 26 can also include a threading portion for receipt of the plurality of indexing pins 28. Preferably, the indexing apertures 26 are located along the face 27 of the flange 14, traverse in some distance through the face 27, and are spaced at predetermined intervals following the diametrical face 27 of the flange 14 to provide for various lockable engagement options. The receivable indexing pins 28 can include a threaded portion to engage corresponding threading in the indexing apertures 26. The indexing pins 28 can provide for needed stability when insertably aligned within those components having index receiving apertures. The primary stability function of the indexing pins 28 is to limit rotation of the member 12 in relation to interlocked components – i.e., another axially connected frame member 12 with flange 14, or a connected hub assembly 18 as shown in Figs. 1d-1e, and 21. Rotational

movement about the longitudinal axis $a_1$ of the member 12 is restricted by the interlocked indexing pins 28.

A limited portion of the connector pin 30 can be inserted into the central aperture 24, aligning axis $a_2$ and $a_4$, such that one of the grooves 31 is alignable with at least one of the end apertures 22 of the frame member 12. The connector fastener 32 is shaped and sized to be removably threaded into the end aperture 22 and through the body aperture 25 of the flange 14, radially in relation to axis $a_2$ and $a_4$, to securably engage the groove 31 of the connector pin 30, pulling or drawing the connector pin and the engaging component (i.e., a hub or frame member) into abuttable securement with the flange 14. The at least one connector fastener 32 can be a set screw, or other fastening means known to one skilled in the art for selectively engaging or locking with such a pin 30. Bolts, screws, and a myriad of other fasteners and fastening means are envisioned for use throughout the present invention when component connectivity is required. The various setscrew fasteners of the present invention can be easily adjustably threaded into the respective apertures or recesses utilizing a setscrew wrench, such as that shown in Fig. 21.

Referring primarily to Figs. 8-9, the hub plate assembly 16 can include a hub plate 33 having at least one connecting branch 34. The plate 33 can further include a plurality of index receiving apertures or recesses 36, and a central plate aperture or recess 38. Each of the connecting branches 34 of the hub plate 33 can include a plurality of branch apertures or recesses 40. The branch apertures 40 can completely pass through the branch 34, or they can define dimpled depressions in the branches 34. The hub plate assembly 16 can further include a first plate connector pin 42 and a second plate connector pin 44, or alternatively, a single unitary-bodied pin. Preferably, the plate connector pins 42, 44 are removably connectable to one another

through the central aperture 38. This connectivity option can be achieved with the use of a threaded portion, wherein one of the pins includes a female threaded portion and the other pin includes a mail threaded portion, and the connectivity of the pins 42, 44 leaves a non-threaded portion of each pin, and axis $a_4$, extending out transverse from the plane of the plate 33. Other known connection methods and techniques are also envisioned.

The hub plate 33 generally has a circular inner portion 35 preferably integral with the at least one connecting branch 34 such that the at least one branch 34 extends out from the inner portion 35 substantially along the same plane. The indexing apertures 36 are preferably spaced around the central aperture 38 through the circular inner portion 35 and are adapted to receive the indexing pins 28 for selective lockable engagement, as demonstrated in Fig. 1d. Embodiments of the hub plate 33 will employ varying branch 34 options, at varying angular configurations. For instance, one embodiment will include a single branch 34, as shown in Fig. 8. Other embodiments will include the angular branch 34 options shown in Figs. 13 and 20. As the figures show, specific embodiments include connecting branches 34 extending away from the inner portion 35 of the hub plate 33 at ninety degree increments, while other embodiments include one-hundred-twenty degree and one-hundred-thirty-five degree increments. A myriad of angular branch 34 configurations in addition to those shown can be employed without deviating from the spirit and scope of the present invention.

Referring to Figs. 6-7, and 10-13, embodiments of the hub assembly 18 are shown. The hub assembly 18 generally comprises a hub 46, and at least one connector fastener 60. The hub 46 can include a central hub aperture or recess 48, a plurality of index receiving apertures or recesses 50, at least one fastening aperture or recess 52, a receiving slot 54, at least one hub contour 56, and a hub face portion 58. In one embodiment, the hub 46 is generally cylindrical in

cross-section (for certain cylindrical tubular frame member 12 systems), defines an axis $a_3$, and is adapted for connection to the frame member 12 by selectively securing a grooved portion 31 of the connector pins 30, 42 through the central hub aperture 48 with the connector fastener 60. Alternatively, the connector pin 42 can include a threaded portion threadably insertable into a mateable threaded central hub aperture 48 such that the groove portion 31 extends out from the hub face portion 58. Like the connector fastener 32 for the end flange 14, the connector fastener 60 of the hub assembly 18 can be a setscrew or like fastening means. As described herein, the other grooved portion 31 of the pin 42 is secured by the connector fastener 32 through the end aperture 22 of the frame member 12 and through the aligned body aperture 25 of the flange 14 such that it engages and selectively locks the connector pin 42 in place within the flange 14. As such, the hub 46 is lockably engaged to the end portion 21 of the frame member 12 at the end flange 14, thus aligning axis $a_1$ and $a_3$, as best demonstrated in Figs. 1d-1e, and 21. This connection results in the receiving slot 54 facing out from the frame member 12.

In one configuration, the index receiving apertures 50 are located on, and pass through, the face portion 58 of the hub 46 for receivable alignment with the indexing pins 28 of the end flanges 14, or other components. The fastening apertures 52 pass through the outer circumferential surface of the hub 46, through the hub 46, and into communication with the central aperture 48 and the receiving slot 54. The receiving slot 54 passes through the central axis of the hub 46, at the portion of the hub 46 distal the face portion 58 and traverses a distance into the hub 46 short of the face portion 58. The slot 54 is generally sized and shaped so that it is capable of slidably receiving the at least one branch 34 of the hub plate 33, as demonstrated in Figs. 10-13. Once received and positioned, at least one of the branch apertures 40 of the respective branch 34 is aligned and in communication with the fastening apertures 52 of the hub

46, wherein a connector fastener 60, such as is demonstrated in Fig. 13, locks the branch 34 in place. The at least one hub contour 56 is sized and shaped to enable confronting slidable engagement with the at least a portion of the outer circumferential surface of corresponding tubular frame members 12, as shown in Fig. 1d-1e. As best demonstrated in Figs. 1d, and 19-21, the contours 56 of multiple hubs 46 interlocked around the connecting braches 34 of the intermediate hub plate 33 provide sufficient spacing for receiving the flange 14 and indexing pins 28 of a respective transversely or radially aligned frame member 12.

The present invention 10 can further include corner joint assemblies 100, such as a fixed corner assembly 102 and/or a pivot corner assembly 104, as shown in Figs. 14-18. The fixed corner assembly 102 of Figs. 14-15 can include a fixed base portion 106 and a fixed angle portion 112. The fixed base portion 106 includes a plurality of base indexing apertures or recesses 108, a concave portion 109, and a central aperture or recess 110. The fixed angle portion 112 includes a corner face portion 114, a plurality of angle portion indexing apertures or recesses 116, and an angle portion central aperture or recess 117. The fixed angle portion 112, in one embodiment, is oriented substantially ninety degrees from the axis of the fixed base portion 106. Other fixed angles between the angle portion 112 and the base portion 106 are envisioned in alternative embodiments. The base indexing apertures 108 and the angle portion indexing apertures 116 are both adapted to receive the indexing pins 28 of the end flanges 14 to provide selective engagement of the fixed corner 102 to respective frame members 12 to provide angular corner portions in a design frame construction. Similarly, the central apertures 110, 117 of the fixed corner assembly 102 are capable of receiving connector pins 30, 42 for further securement at one end within the central aperture 24 of respective end flanges 14 for attachment using the connector fastener 32 and methods described herein. The concave portion 109 is sized and

shaped to compatibly confront at least a portion of the outer circumferential surface of a respective frame member 12 upon connection of the end flange 14 to the fixed angle portion 112, as demonstrated in Fig. 15. Indexing pins 28 are also used as with any component capable of lockable engagement with the flange 14 of a frame member 12.

The pivot corner assembly 104 of Figs. 16-18 can include a pivot base portion 120, and a pivot arm 132. Locking interval pins 140 can also be included. The pivot base portion 120 can include pivot base first indexing apertures or recesses 122, a pivot base central aperture or recess 124, a pivot base concave portion 126, a pivot base axial groove 128, and pivot base second indexing apertures or recesses 130. The pivot arm 132 includes a pivot aperture or recess 134, a pivot central aperture or recess 135, a pivoting device 136, and pivot arm indexing apertures or recesses 138. The pivot arm 132 is capable of pivotable movement around the pivot device 136 for selective angular configurations. When a specific angular setting is obtained, the pivot device 136, such as a pin, screw, bolt, and the like is lockably secured to temporarily fix the pivot arm 136 at the desired angle. In the embodiment of Fig. 16, the locking interval pins 140 are insertable into a portion of the pivot arm 136 to further stabilize the pivot arm 36 upon setting the arm 136 to the desired angle. These locking interval pins 140 are generally insertable into groove apertures or recesses 129 within the axial groove 128 of the base portion 120, and can provide predefined, but selective, angular configurations for the pivot arm 136 of approximately zero degrees, forty-five degrees, and ninety-degree increments. Other predefined angular options are also envisioned. Without the interval pins 140, the arm 136 is capable of adjustment along a myriad of angular settings. Again, the central apertures 124, 135 of the pivot corner assembly 104 are capable of receiving connector pins 30, 42 for further securement at one end within the central aperture 24 of respective end flanges 14 for attachment using the connector fastener 32

and methods described herein. The concave portion 126 defines a curved surface allowing the end of the pivot arm 136, distal the pivot central aperture 135, free pivoting movement. Indexing pins 28 are also used as with any component capable of lockable engagement with the flange 14 of a frame member 12.

Referring primarily to Figs. 19-31, various plates, caps, end plates, and like components can be attached to frame member 12 end portions 21 via the versatile and modular end flange 14 design and/or the hub plate 33. For instance, Figs. 19-21 show the implementation of an end filler cap 80 attachable to the hub plate 33 which is thereby secured to the flange 14 of the frame member 12. The end filler cap 80 can include at least one cap aperture or recess 81, and a plurality of cap indexing apertures or recesses 81a. The at least one cap aperture 81 can receive any one of the connecting pins 30, 42 to provide coupleable engagement with the hub plate central aperture 38 and the central aperture 24 of the flange 14. The connecting pin, preferably one of the two joinable pins 42, 44, is then locked in place with the connector fastener 32 through the end aperture 22 of the frame member 12. Again, the indexing pins 28 can provide rotational stability. The cap indexing apertures 81a can receive one end of the indexing pins 28 while the other is aligned with an indexing aperture 26 of the flange 14. End filler caps 80 of the present embodiment can increase aesthetic appeal by closing off exposed hub 18 and hub plate 16 components. Further, the end filler caps 80 can increase stability and strength of frame member 12 junctures by filling in the voids between the hub 18 and hub plate 16 assemblies. The hub contours 56 of proximate hub assemblies 18 in a hub juncture, such as those shown in Figs. 19-21, are each generally shaped and sized to engage a portion of the circumferential surface of the end filler cap 80.

Various end caps 150a, 150b can also be employed with the present invention to cap off exposed flanges 14 of the members 12. For instance, Figs. 22-25 show two embodiments of the end caps 150a, 150b coupled in such a manner. Figs. 22-23 show a large end cap 150a, the cap 150a including a cap aperture or recess 152 for securably receiving one of the connector pins 42, 44 for insertion into the central aperture 24 of the flange 14. In a preferred embodiment, a pin 42 having male threading at one end is threadably secured within the cap aperture 25 such that a grooved end 31 of the pin 42 is insertable within the central aperture 24 of the flange 14. As such, fastener 32 engages the groove 31 of the connector pin 42 through the end aperture 22 of the frame member 12 to selectively lock the cap 150a in place. In addition, indexing pins 28 within the indexing apertures 26 of the flange 14 can be inserted into aligned apertures in the cap 150a to provide rotational stability. Figs. 24-25 show a thin end cap 150b, wherein the end cap 150b includes the cap aperture 152 for threadably receiving the threaded connector pin 42. Again, a grooved portion 31 of the connector pin 42 is insertable within the central aperture 24 of the flange 14 to provide selective lockable engagement with fastener 32 through end aperture 22 of the frame member 12. In at least one embodiment, this relatively thin end cap 150b embodiment does not utilize indexing pins 28. Aesthetic appeal and functionality are enhanced with each of the end caps 150a, 150b.

To facilitate standing frameworks, it may be necessary to include various stands, feet, pods and other supporting members at end portions of particular frame members 12. Figs. 26-31 demonstrate embodiments of these supporting members adapted for implementation with the present invention. In Figs. 26-27 a base stand 154 including a base stand coupling 156 is shown for use with the present invention. The base stand 154 is generally disc shaped and can be of varying sizes depending on the support needs of the particular framework configuration. Other

shapes and proportional configurations are envisioned as well. The base stand coupling 156 is connectably positioned on the base stand 154 for lockable engagement with the hub plate 33 of the hub plate assembly 16 or the flange 14 of the frame member 12. When connected to the hub plate 33, connector pin 42 can be insertable within the flange 14 central aperture 24, while the other connector pin 44 is insertable into the base standing coupling through a centrally traversing coupling aperture 158. A side stand fastening aperture 160 transverse to, but in communication with, the coupling aperture 158 can be included for receiving the connector fastener 60 to lock the base stand 154 against the grooved portion 31 of the inserted pin 44. Indexing pin 28 can be utilized to further secure the base stand 154 to the hub plate assembly 16 for increased rotational stability.

Referring primarily to Figs. 27-29, and 31, a foot pod system 162 is shown. The foot pod system 162 includes a base pod 164, a base cap 166, and at least one pod fastener 168. The base pod 164 is generally disk shaped and includes a threaded shaft 165 extending out from the pod 164. The base cap 166 can include a plurality of base cap apertures or recesses 170. In attaching the foot pod 162 to the flange 14 of the frame member 12, the hub plate 33 is positionally aligned intermediate the flange 14 and the base cap 166 such that the pod fasteners 168 can be inserted up into the base cap apertures 170, through the index receiving apertures 36 of the hub plate 33, and into the indexing apertures 26 of the flange 14, as best shown in Fig. 28. Upon alignment, the fasteners 168 can be tightened to fasten the base cap 166 to the hub plate 33 at the end portion 21 of the frame member 12. The threaded shaft 165 of the base pod 164 can then be threadably inserted and secured within one of the base cap apertures 170, as shown in Fig. 29. As such, a support stand or pod is provided at the end of the respective frame member 12 to increase stability and support for the framework system 10. Fig. 31 shows another view of an

embodiment of the foot pod system 162, with base cap 166, being connected through to the hub plate 33 of a two hub assembly 18 system.

An alternate embodiment of the foot pod system 162 is included in Fig. 30. This embodiment includes the base pod 154 and corresponding threaded shaft 165. However, connectivity with the frame member 12 can be achieved without the base cap 166 or intermediate hub plate 33. To facilitate this connection to the flange 14 of the frame member 14, the threaded shaft 165 can further include an end ball joint 176, and a longitudinally threadably adjustable elongate nut 172 having an intermediate groove 174. The elongate nut 172 is insertable along with the threaded shaft 165 into the central aperture 24 of the flange 14, along aligned axis $a_1$ and $a_2$, wherein the fastener 32, such as the setscrew 32, can secure the foot pod 162 in place by engaging the intermediate groove 174 of the elongate nut 172. Longitudinal adjustments of the elongate nut 172 along the length of the threaded shaft 165 provide for selective height adjustments for the pod 162 in relation to the respective frame member 12. The ball joint 176 is at least partially shrouded within the base pod 164 to enable angular adjustments of the shaft 165 in relation to the base pod 164.

Referring to Figs. 32-36, the framework connection system 10 can further include a clamp assembly 20. In one embodiment, the clamp assembly 20 can include a first clamp 62, a second clamp 64, and lock fasteners 68, with each clamp including locking channels 66, attachment apertures 70, inner circumferential surfaces 72, outer circumferential surfaces 76, and an inner attachment lining 74. In those embodiments utilizing cylindrical tubing frame members 12, the clamp assembly 20 is substantially cylindrical, with the inner surface 72 sized and shaped for confronting engagement around the outside surface of the frame members 12. In addition, the outer circumferential surfaces 76 of the clamps 62, 64 can include surface flats 76a. Any

surface of the clamps 62, 64 can include the attachment apertures 70, including the flats 76a. Unlike conventional clamping devices, the clamp assembly 20 of the present invention permits selective placement and removal of the claim assembly 20 along the length of the frame member 12 without the need to remove all frame attachments or appurtenances. The clamp portions 62, 64 can be separated and removed, wherein conventional unitary-bodied clamps require users to slide the clamp off an end portion of the frame member after removing each shelf, lamp, or other appurtenance that may be positioned between the clamp and the end of the frame member.

The first clamp 62 and the second clamp 64 are joined at the confronting locking channels 66 of the respective clamps 62, 64 for selective engagement with a corresponding frame member 12. The locking fasteners 68, such as screws, bolts, and like means are inserted into the channels 66 to secure the clamps 62, 64 together around the frame member 12. Other locking means known to one skilled in the art can also be employed.

The inner attachment lining 74 is generally positioned along the inner circumferential surfaces 72 of the clamps 62, 64, and as a result, can include two separate linings 74. The lining 72 can serve many purposes, such as minimizing damage to the frame member 12 during the positioning, adjusting, and removing of the clamp assembly 20 from the frame members 12, and to facilitate attachment. In one embodiment, the attachment lining 74 can be constructed of plastics, rubbers, or other like materials to protect the surfaces of the clamp assembly 20 and the engaged frame member 12 from scratching, and to provide effective slidability. In another embodiment, the lining 74 is constructed of a magnetic material or member to facilitate ease-of-attachment and stability during use. In both embodiments, the lining 74 can be attached to the inner surfaces 72 of the clamps 62, 64 with adhesives or other known bonding techniques and means.

Various other embodiments of the clamp assembly 20, with one such embodiment shown in Fig. 32a, will include a hinge device 67, wherein the first clamp 62 includes a first hinge portion 67a and the second clamp 64 includes a second hinge portion 67b. Generally, one of the respective first and second clamp locking channels 66 and locking fasteners 68 are replaced with the hinge 67 and the corresponding hinge portions 67a, 67b. The corresponding hinge portions 67a, 67b are pivotably mateable with a member such a hinge pivot pin 69 therethrough. The hinge 67 provides a pivoting joint connecting the clamps 62, 64 for selective rotational adjustment of the clamps 62, 64 in relation to each other to facilitate placement on and removal of the assembly 20 from the frame members 12. Tab receiving recesses 71 can be included for attaching the inner lining 74, as shown in Fig. 32a. However, other hinged embodiments of the clamp assembly 20 will connect a liner, magnetic member, and the like to the inner circumferential surface 72 of at least one of the clamps 62, 64 using the adhesive or other bonding techniques and methods described herein.

A myriad of frame system attachments and appurtenances 178 can be secured to the frame members 12 by way of the clamp assembly 20 and the attachment apertures 70, as shown in Figs. 34-36. For instance appurtenances 178 such as computer monitor support bars, screen attachment tubing and apparatus, lighting, banner connectors, shelves, literature racks, plasma supports, support brackets, CPU cabinets, keyboard tables, counters, and like components and accessories systems can be selectively attached to the attachment apertures 70 of the clamp assembly 20. Referring to Fig. 34, a collar frame connector assembly 180 is shown. The collar assembly 180 generally includes at least one collar bracket 190 secured to the attachment apertures 70, and a linking assembly 192. The collar assembly 180, and the linking assembly

192 in particular, are adapted to lockably engage the flange 14 of a frame member 12 to provide an additional connectivity option for the present invention.

Fig. 35 shows two clamp assemblies 20 spaced along the length of the frame member 12 to provide support for a display mounting assembly 182, such as those used to support computer displays and plasma screens. The display mounting assembly 182 can include a frame assembly and connecting brackets 186, wherein the brackets 186 are secured to the attachment apertures 70 of the clamp assembly 20. Fig. 36 demonstrates how a clamp assembly 20 can be utilized to secure a counter appurtenance 190 to the framework system at selective locations along the length of a frame member 12. The counter or shelf 190 is positioned to rest upon the clamp assembly 20 and secured into at least one of the clamps 62, 64 through the attachment apertures.

Figs. 37-38 show a bracket device 192 which can include a central body portion 194, at least one bracket branch 196, bracket indexing apertures 198, and a bracket central aperture 200. Connector blocks 202 can also be included to provide modular connectivity for other tubing members, such as those tubing segments, members, and devices disclosed and taught in U.S. Patent Application Nos. 09/953,113 and 09/953,111, which are hereby incorporated by reference in their entirety. Other connectors or small tubing segments can be joined to the bracket device 92 using various connections, such as clips, snaps, tracks, and like connection means without deviating from the spirit and scope of the present invention. The branch 196 can be elongate branches as shown in Figs. 37-38, or they can take the form of clips or other connectors. In addition, a plurality of branches 196 can be employed, at various angles with respect to the central portion 194 and other branches 196. The central body portion 194 is preferably sized and shaped for intermediate positioning and securement between two frame members 12 and their corresponding flanges 14 with the bracket branch 196 extending some distance out transverse or

radial to the axis $a_1$ of the frame members 12. As such, the bracket central aperture 200 and the bracket indexing apertures are adapted to intermediately receive the connector pin 30, 42 and indexing pins 28, respectively, as demonstrated in Fig. 37. Upon securement of the end portions 21 and flanges 14 of the confronting frame members 12, the bracket device 192 is locked into place.

The system 10 of the present invention can further include various assemblies and connection components adapted to facilitate compatible interconnectivity with other framing systems. For instance, an end plate 82 assembly, as in Figs. 39-40, having a plurality of receiving apertures or recesses 83 can be included to connection to box frame assemblies such as the system described and disclosed in previously incorporated U.S. Patent Application Nos. 09/953,113 and 09/953,111. The receiving apertures 83 can be spaced to match corresponding box frame trusses or other frame members on one side, and aligned for lockable connection with indexing pins 28 and/or the connector pin 42 of the end flanges 14 on the other side. Connectors, such as the connector blocks 202, can be secured to appropriate portions of at least one side of the end plate 82 to facilitate connection to the other frame members. As shown in Fig. 39, and as described herein, the connector pin 30, 42 can be threaded at one end for attachment to the end plate assembly 82. Other embodiments may weld the plate 82 to the frame members 12, or implement a myriad of other attachment techniques and methods. With such a configuration it is possible to join frame systems having very different shapes and structural characteristics, such as the joining of cylindrical tubing framing systems to square tubing box frame systems. Other possible combinations and end plate shapes are envisioned for joining frame systems having different shapes.

Referring primarily to Figs. 1d-1e, and 21, in use the framework connection system 10 of the present invention provides the end user with a wide variety of angular configuration options using selective combinations of one or more of the end flanges 13, the hub plate assemblies 16, and the hub assemblies 18. The following examples are merely to provide instruction on some of the potential permutations available to the end user, and are not intended to be at all exhaustive.

In one embodiment, the system 10 can be quite simplistic in its configuration by providing for a direct connection of two axially aligned frame members 12. With such a configuration, the connector pin 30 having two substantially identical ends with grooves 31, is inserted into the central apertures 24 of the respective flanges 14 along axis $a_2$, wherein connector fasteners 32 are inserted through the end apertures 22 of the frame members 12 to removably lock the frame members 12 abuttably together. The connector fasteners 32 engage the grooves 31 of respective end portions of connector pin 30 to achieve engagement in one embodiment. The indexing pins 28 can be included within the indexing apertures 26 of abutting flanges 14 to provide rotational stability. A plurality of these frame members 12, straight or curvilinear, can be connected one after the other in series.

In other embodiments, as demonstrated in Figs. 1d-1e, and 21, the hub plate 33 and corresponding connecting branches 34 are connectable to hub assemblies 18 to further increase the angular configuration options of the system. Generally speaking, a corresponding hub 46 and hub assembly 18 is matched with every connecting branch 34 of the subject hub plate 33 such that the hub plate 33, and the inner portion 35 in particular, interpose the hubs 46. The branches 34 are slidably received in the receiving slots 54 of the hubs 46. In those embodiments wherein the branches 34 are positioned at ninety-degree intervals, this will result in a maximum of four

angular options along the plane of the plate 33, for each plate 33 integrated into the system 10. For instance, as shown best in Figs. 1d, a three-way hub plate assembly 16 can be included, wherein the three hub plate 33 connecting branches 34 are connectable to three transversely aligned respective hub assemblies 18 via the hub receiving slots 52. In turn, the hub assemblies 16, at the end opposite the receiving slots 52, are locked with connector pins 30, 42, and/or aligned with the indexing pins 28, to axially align the hub assemblies 16 with the respective flanges 14 of the frame members 12 along axis $a_1$ and $a_2$. Further, two frame members 12 can be lockably secured to the inner portion 35 of the hub plate 33, transverse to the plane of the plate 33, using the plate connector pins 42, 44. With such a configuration, a five member 12 juncture is created. Alternatively, a filler cap 80 can be inserted to fill in the exposed inner portion 35 of the plate 33.

Similarly, if a four branch 34 hub plate 33 is employed, it is possible to create a six member 12 juncture. Even a rather simple one way branch 34 hub plate assembly 16 can provide for a three member 12 juncture with the attachment of the hub 46 to the one branch 34, and the transverse attachment of two additional members 12 at the inner portion 35 of the plate 33. Moreover, clamp assemblies 20, filler caps 80, end plates 82, corner joints 100, base stands 154, foot pods 162 and other components and assemblies can substitute for, or be incorporated with, the members 12. It should be obvious to one skilled in the art that the removal, addition, and the selective combination of various system components leaves the end user with a multitude of angular, functional, and aesthetic configuration options, of which only a few have been described to merely advance an understanding of the advantages of the present invention. Combining the selective modular configuration of system 10 of the present invention with other appurtenances

178, screens, and components and systems known to one skilled in the art for use with display frameworks are demonstrated in Figs. 1a-1c.

Although the invention herein has been described by way of examples of preferred and alternative demonstrative embodiments, it will be evident that other adaptations and modifications may be employed without departing from the spirit and scope of the present invention. The terms and expressions employed herein have been used as terms of description and not of limitation. There is no intent to exclude equivalents and selective combinations, and it is intended that the description cover any and all equivalents that may be employed without departing from the spirit and scope of the invention.